The Complete Solution To $A\mathbf{x} = \mathbf{b}$ (Part II)

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Overview

This is a project, extending over two lab meetings, in which we will implement a sophisticated algorithm for finding the complete solution to $A\mathbf{x} = \mathbf{b}$ (if it has a solution). Comprehensive usage of the `for` and `if` structures are required. One major goal is to convert pseudocode into formal MATLAB code.

Activities

- To solve $Ax = b$ for x, type

  ```
  >> x = A\b
  ```

  Try this on the example in the notes. Note: This is unreliable for when the system has free variables. Hence why we will create such a function in today's lab.

In-Class Exercise

Goal: For a given matrix A and vector b, find the complete solution to $Ax = b$.

Algorithm Step 1: Find the particular solution. Set the free variables equal to 0. Solve for the pivot variables in $Ax = b$.

1. Initialize the particular solution.
2. Use your `csolve.m` function to find the pivot and free columns of A.
3. Find the resulting matrix pA (as in the notes).
4. Solve $pA\tilde{x} = b$.
5. Record the solution $\tilde{x}$ in the appropriate indexes in x_p.

Algorithm Step 2: Find the special solution(s). Set each free variable equal to 1 and the rest of the free variables equal to 0. Solve for the pivot variables in $Ax = 0$. Store the special solutions as a matrix with each column corresponding to a free variable equal to 1.

1. Initialize the special solution(s).
2. Iterate for each free variable.
3. Set the ith free variable equal to 1 and solve the resulting system.
4. Record the solution in the appropriate indexes in x_s.